

Attendance Problems. Substitute the given values of m , x , and y into the equation $y = mx + b$ and solve for b .

1. $m = 2$, $x = 3$, and $y = 0$

2. $m = -1$, $x = 5$, $y = -4$.

Solve each equation for y .

3. $y - 6x = 9$

4. $4x - 2y = 8$

- I can graph lines and write their equations in slope-intercept and point-slope form.
- I can classify lines as parallel, intersecting, or coinciding.

Vocabulary	
point-slope form	slope-intercept form

Common Core: **CC.9-12.G.GPE.5** Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of line parallel or perpendicular to a given line that passes through a given point).

Forms of the Equation of a Line

FORM	EXAMPLE
The point-slope form of a line is $y - y_1 = m(x - x_1)$, where m is the slope and (x_1, y_1) is a given point on the line.	$y - 3 = 2(x - 4)$ $m = 2, (x_1, y_1) = (3, 4)$
The slope-intercept form of a line is $y = mx + b$, where m is the slope and b is the y-intercept.	$y = 3x + 6$ $m = 3, b = 6$
The equation of a vertical line is $x = a$, where a is the x-intercept.	$x = 5$
The equation of a horizontal line is $y = b$, where b is the y-intercept.	$y = 2$

Remember!

A line with y-intercept b contains the point $(0, b)$.
A line with x-intercept a contains the point $(a, 0)$.

PROOF Point-Slope Form of a Line

Given: The slope of a line through points (x_1, y_1) and (x_2, y_2) is $m = \frac{y_2 - y_1}{x_2 - x_1}$.

Prove: The equation of the line through (x_1, y_1) with slope m is

$$y - y_1 = m(x - x_1).$$

Proof:

Let (x, y) be any point on the line.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Slope formula

$$m = \frac{y - y_1}{x - x_1}$$

Substitute (x, y) for (x_2, y_2) .

$$(x - x_1)m = (x - x_1)\frac{y - y_1}{x - x_1}$$

Multiply both sides by $(x - x_1)$.

$$m(x - x_1) = (y - y_1)$$

Simplify.

$$y - y_1 = m(x - x_1)$$

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Video Example 1. Write the equation of each line in the given form.

A. The line with slope 4 through $(1, 2)$ in point-slope form.

B. The line through $(0, -2)$ and $(4, 2)$ in slope-intercept form.

C. The line with x-intercept -3 and y-intercept 2 in point-slope form.

1 Writing Equations of Lines

Write the equation of each line in the given form.

A the line with slope 3 through (2, 1) in point-slope form

$$y - y_1 = m(x - x_1)$$

Point-slope form

$$y - 1 = 3(x - 2)$$

Substitute 3 for m , 2 for x_1 , and 1 for y_1 .

B the line through (0, 4) and (−1, 2) in slope-intercept form

$$m = \frac{2 - 4}{-1 - 0} = \frac{-2}{-1} = 2$$

Find the slope.

$$y = mx + b$$

Slope-intercept form

$$4 = 2(0) + b$$

Substitute 2 for m , 0 for x , and 4 for y to find b .

$$4 = b$$

Simplify.

$$y = 2x + 4$$

Write in slope-intercept form using $m = 2$ and $b = 4$.

C the line with x -intercept 2 and y -intercept 3 in point-slope form

$$m = \frac{3 - 0}{0 - 2} = -\frac{3}{2}$$

Use the points (2, 0) and (0, 3) to find the slope.

$$y - y_1 = m(x - x_1)$$

Point-slope form

$$y - 0 = -\frac{3}{2}(x - 2)$$

Substitute $-\frac{3}{2}$ for m , 2 for x_1 , and 0 for y_1 .

$$y = -\frac{3}{2}(x - 2)$$

Simplify.

Example 1. Write the equation of each line in the given form.

A. The line with slope 6 through (3, −4) in point-slope form.

B. The line through (−1, 0) and (1, 2) in slope-intercept form.

C. The line with the x -intercept 3 and y -intercept -5 in point slope form.

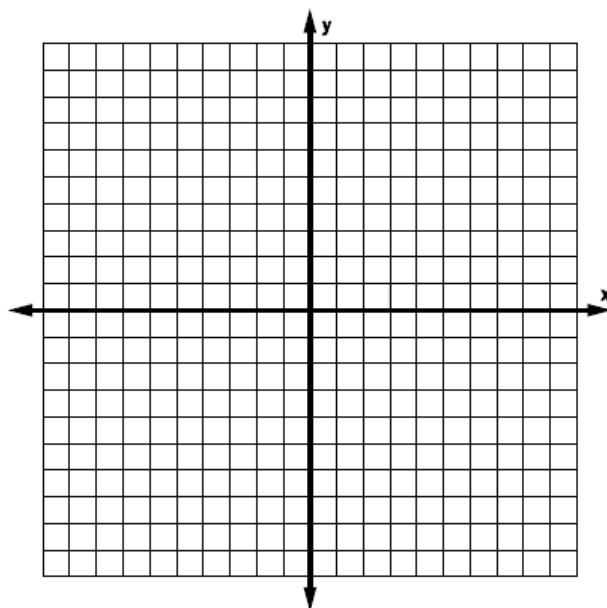
Guided Practice. Write the equation of each line in the given form.

5. The line with slope 0 through (4, 6) in slope-intercept form.

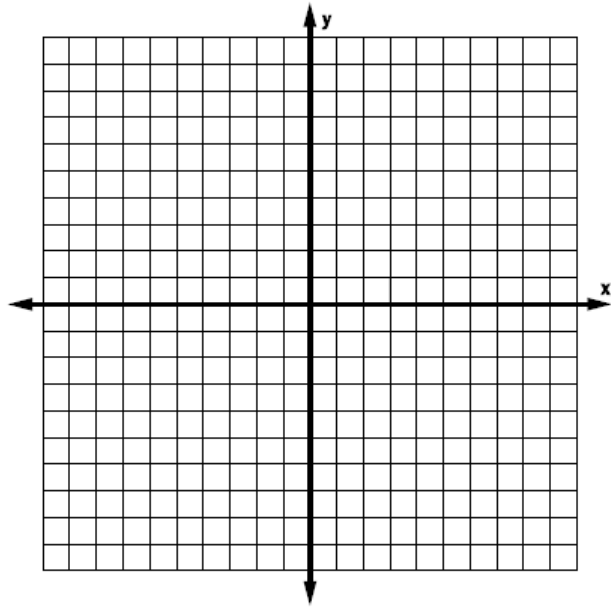
6. The line through $(-3, 2)$ and $(1, 2)$ in point-slope form.

Video Example 2. Graph each line.

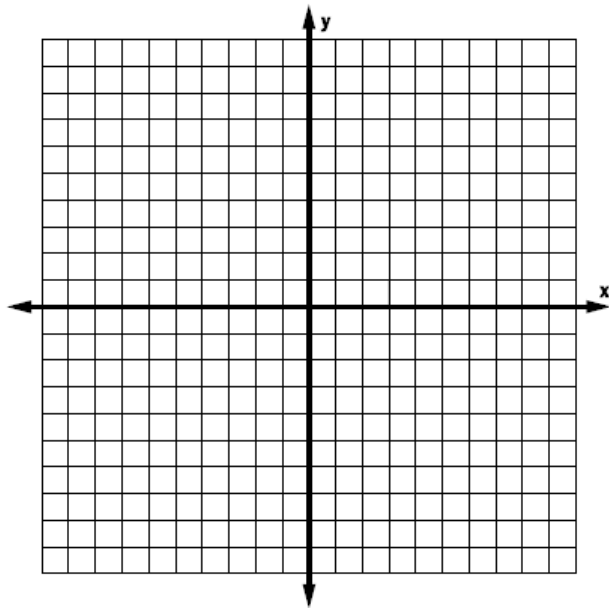
A. $y = \frac{2}{3}x + 2$



B. $y + 4 = -3(x - 2)$



C. $x = -5$



2 Graphing Lines

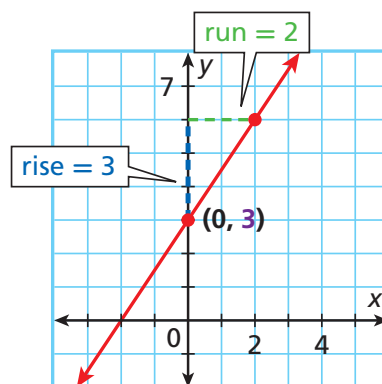
Graph each line.

A $y = \frac{3}{2}x + 3$

The equation is given in slope-intercept form, with a slope of $\frac{3}{2}$ and a y -intercept of 3.

Plot the point $(0, 3)$ and then rise 3 and run 2 to find another point.

Draw the line containing the two points.

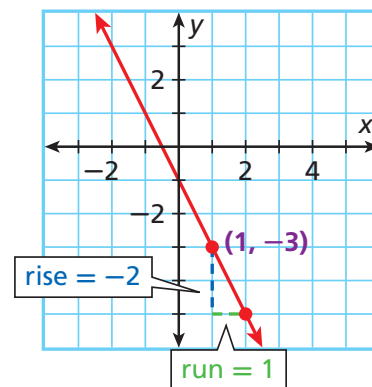


B $y + 3 = -2(x - 1)$

The equation is given in point-slope form, with a slope of $-2 = \frac{-2}{1}$ through the point $(1, -3)$.

Plot the point $(1, -3)$ and then rise -2 and run 1 to find another point.

Draw the line containing the two points.

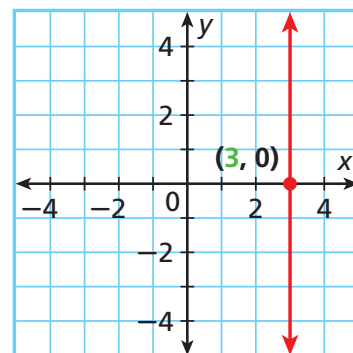


Graph the line.

C $x = 3$

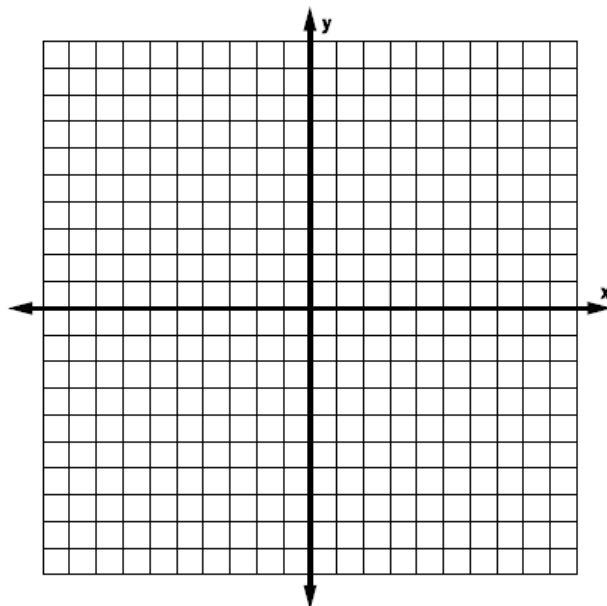
The equation is given in the form for a vertical line with an x -intercept of 3.

The equation tells you that the x -coordinate of every point on the line is 3. Draw the vertical line through $(3, 0)$.

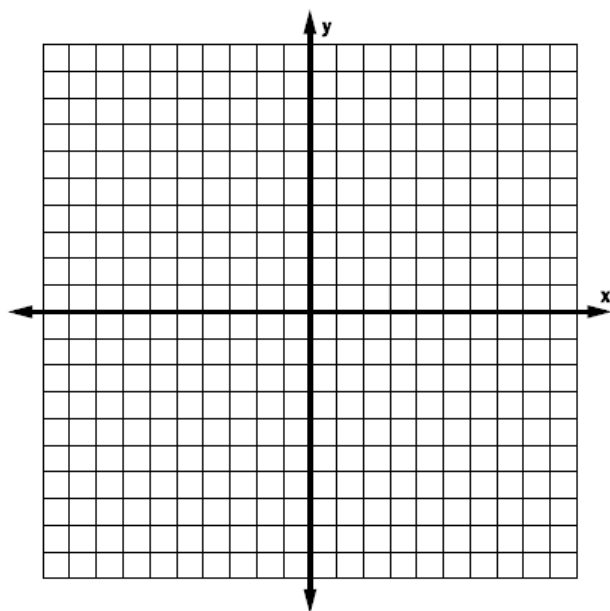


Example 2. Graph each line.

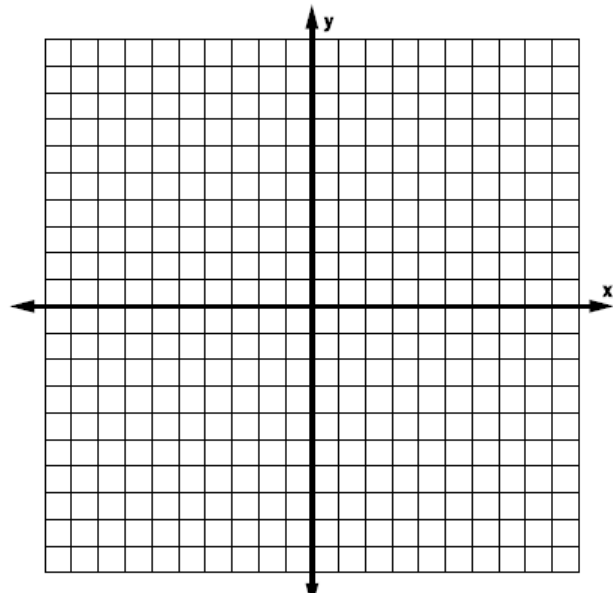
A. $y = \frac{1}{2}x + 1$



B. $y - 3 = -2(x + 4)$



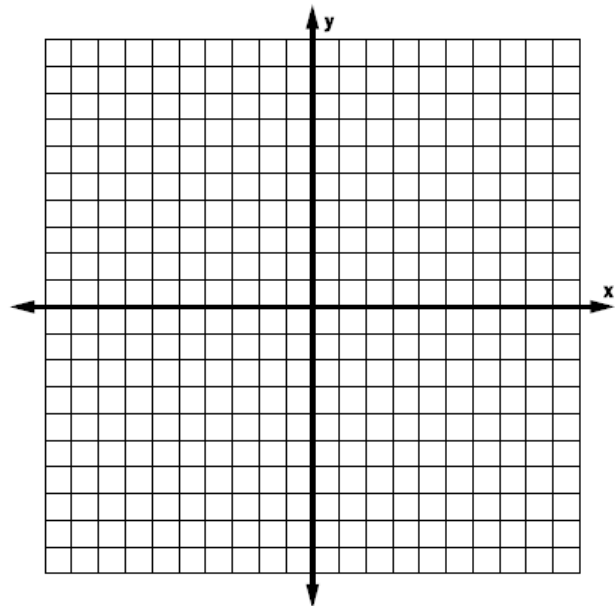
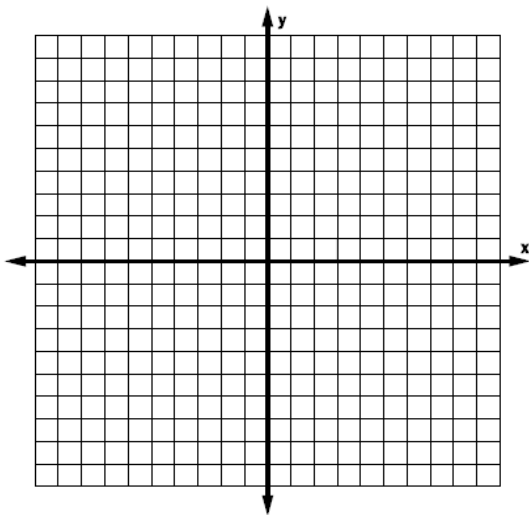
C. $y = -3$



Guided Practice. Graph each line.

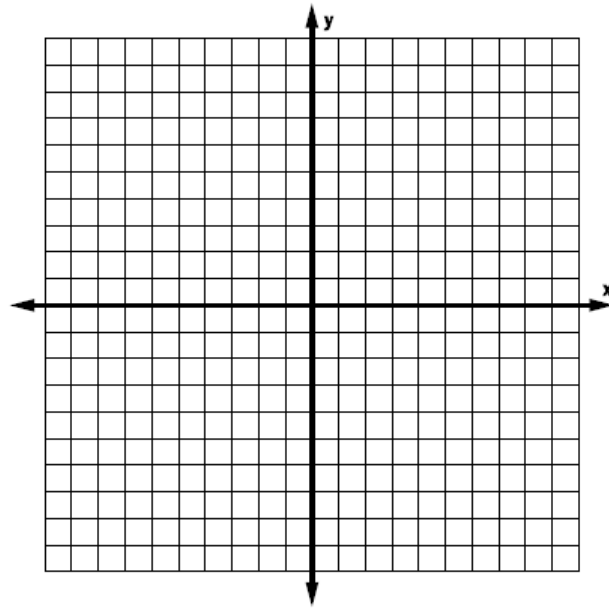
7. $y = 2x - 3$

8. $y - 1 = -\frac{2}{3}(x + 2)$



9. $y = -4$

A system of two linear equations in two variables represents two lines. The lines can be parallel, intersecting, or coinciding. Lines that coincide are the same line, but the equations may be written in different forms.



Desmos Activity: Slopes of Parallel and Perpendicular Lines
CLASS CODE: d7yr

Pairs of Lines

PARALLEL LINES	INTERSECTING LINES	COINCIDING LINES
$y = 5x + 8$	$y = 2x - 5$	$y = 2x - 4$
$y = 5x - 4$	$y = 4x + 3$	$y = 2x - 4$
Same slope different y-intercept	Different slopes	Same slope , same y-intercept

Video Example 3. Determine whether each pair of lines are parallel, intersect or coincide.

A. $y = 3x + 3$
 $y = 3x - 1$

B. $y = x - 4$
 $2x - 2y = 8$

C. $4x + 3y = 8$
 $4y = 3x + 8$

3 Classifying Pairs of Lines

Determine whether the lines are parallel, intersect, or coincide.

A $y = 2x + 3, y = 2x - 1$

Both lines have a slope of 2, and the y -intercepts are different.
 So the lines are parallel.

B $y = 3x - 5, 6x - 2y = 10$

Solve the second equation for y to find the slope-intercept form.

$$6x - 2y = 10$$

$$-2y = -6x + 10$$

$$y = 3x - 5$$

Both lines have a slope of 3 and a y -intercept of -5 , so they coincide.

C $3x + 2y = 7, 3y = 4x + 7$

Solve both equations for y to find the slope-intercept form.

$$3x + 2y = 7$$

$$2y = -3x + 7$$

$$y = -\frac{3}{2}x + \frac{7}{2} \quad \text{The slope is } -\frac{3}{2}.$$

$$3y = 4x + 7$$

$$y = \frac{4}{3}x + \frac{7}{3}$$

The slope is $\frac{4}{3}$.

The lines have different slopes, so they intersect.

Example 3. Determine whether each pair of lines are parallel, intersect or coincide.

A. $y = 3x + 7$
 $y = -3x - 4$

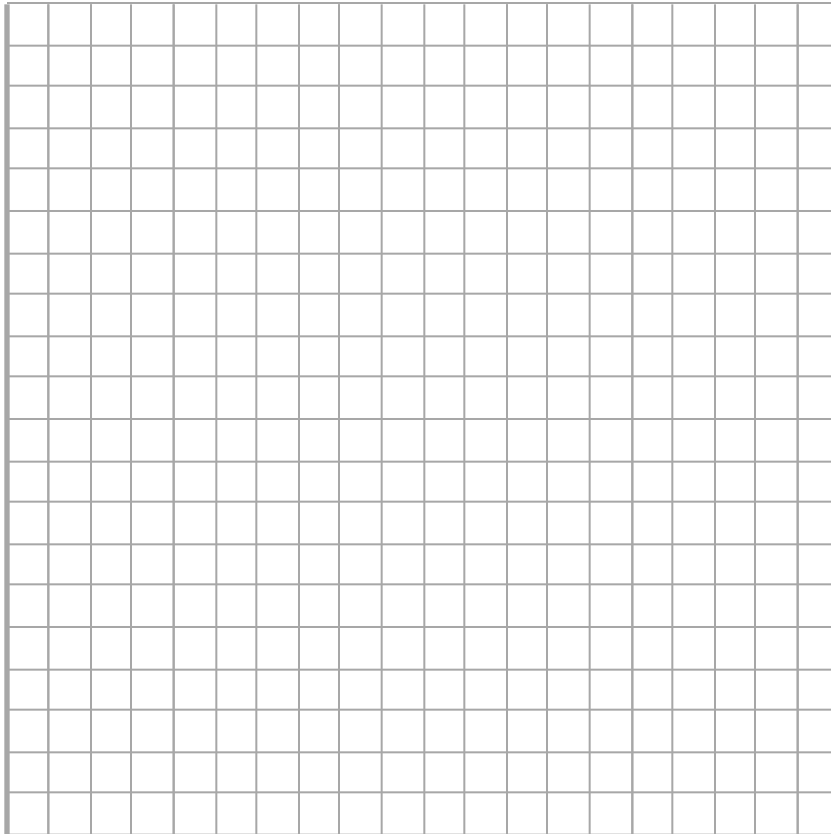
B. $y = (-1/3)x + 5$
 $6y = -2x + 12$

C. $2y - 4x = 16$
 $y - 10 = 2(x - 1)$

10. Guided Practice. Determine whether the lines $3x + 5y = 2$ and $3x + 6 = -5y$ are parallel, intersect, or coincide.

Video Example 4. Audrey is trying to decide between two health plans. After how many months would both plans' total costs be the same?

	Plan A	Plan B
Enrollment Fee	\$100	\$0
Monthly Fee	\$40	\$60



4 Problem-Solving Application

Audrey is trying to decide between two health club plans. After how many months would both plans' total costs be the same?

	Plan A	Plan B
Enrollment Fee	\$140	\$60
Monthly Fee	\$35	\$55

1 Understand the Problem

The **answer** is the number of months after which the costs of the two plans would be the same. Plan A costs \$140 for enrollment and \$35 per month. Plan B costs \$60 for enrollment and \$55 per month.

2 Make a Plan

Write an equation for each plan, and then graph the equations. The solution is the intersection of the two lines. Find the intersection by solving the system of equations.

3 Solve

$$\text{Plan A: } y = 35x + 140$$

$$\text{Plan B: } y = 55x + 60$$

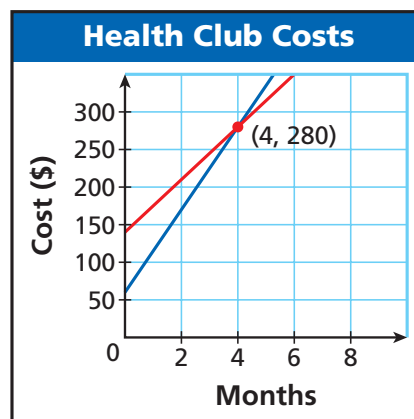
$$0 = -20x + 80 \quad \text{Subtract the second equation from the first.}$$

$$x = 4 \quad \text{Solve for } x.$$

$$y = 35(4) + 140 = 280 \quad \text{Substitute 4 for } x \text{ in the first equation.}$$

The lines cross at (4, 280).

Both plans cost \$280 after 4 months.

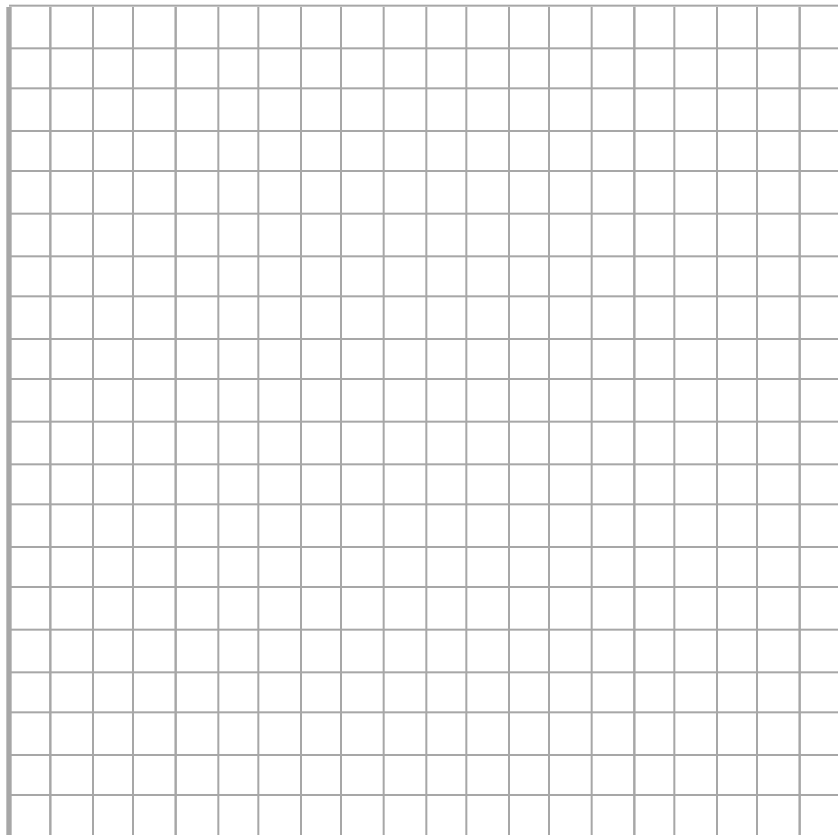


4 Look Back

Check your answer for each plan in the original problem. For 4 months, plan A costs \$140 plus $35(4) = \$140 + \$140 = \$280$. Plan B costs $60 + 55(4) = \$60 + \$220 = \$280$, so the plans cost the same.

Example 4. Erica is trying to decide between two car rental plans. For how many miles will the plans cost the same?

	Plan A	Plan B
Initial Fee	\$100.00	\$85.00
Mileage Fee	\$0.35/mi	\$0.50



7. Guided Practice. Suppose the rate for Plan B was also \$0.35 per mile. What would be true about the lines that represent the cost of each plan?

3-6 Assignment

(194-196) 13, 15, 17-21, 23, 28, 32, 36, 53, 56, 57.

3B Ready to Go On & posttest.